Getting Closer to Better Biocontrol for Garden Pests

Agricultural Research Service scientists are moving closer to developing an environmentally friendly bacteria-based biocontrol agent that offers long-lasting protection against caterpillars and other pests in a garden or cultivated field.

Bacillus thuringiensis (Bt) is now used to control gypsy moths, tent caterpillars, leaf rollers, canker worms, and other pests that attack garden plants, corn, and other crops. But the commonly used strain, *B. thuringiensis kurstaki,* doesn't survive more than one generation. After an initial round of pests is killed, the biocontrol dies out and the pests return.

Michael Blackburn, an entomologist at the Invasive Insect Biocontrol and Behavior Laboratory in Beltsville, has been searching among the 3,500 characterized *Bt* strains in the ARS Beltsville Bacterial Collection for a strain that will not only kill an initial generation of pests, but will also survive to kill later generations.

Blackburn and his colleagues are classifying strains in the collection based on the compounds the bacteria metabolize and produce. As part of that effort, they tested 50 strains of *Bt* known to be toxic to gypsy moths, including *kurstaki,* and found they could be divided into two groups: those that produce an enzyme called "urease" and those that don't. They fed the 50 strains to gypsy moth larvae, and when those caterpillars died, they ground them up and applied them to pellets of artificial diet. They then fed the pellets to another cycle of caterpillars.

The researchers looked at survival rates of the bacteria over several generations of caterpillars and found that urease-producing phenotypes survived better when repeatedly fed to gypsy moths. Of 26 urease-producing *Bt* strains, 23 survived 5 passages through gypsy moth larvae, while none of the 24 strains that don't produce urease survived them.

The results, published in *Biological Control,* bring scientists a step closer to finding a *Bt* strain that will be more effective at combating gypsy moths and possibly other insect pests. The efforts should also lead to the discovery of *Bt* strains with other desirable traits, such as the ability to grow on mulch, multiply on specific crops, or thrive in gardens and other sites favored by a targeted pest.—By **Dennis O'Brien,** ARS.

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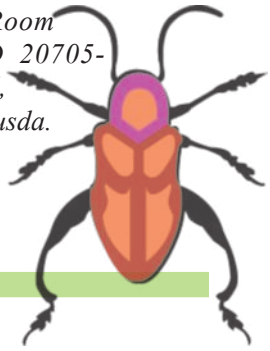

Vaccine for Anaplasmosis Under Development

Molecular biologist Susan Noh, at the Agricultural Research Service's Animal Disease Research Unit in Pullman, Washington, is working to develop a vaccine to protect against anaplasmosis, a tick-transmitted disease of cattle. Caused by the microbe *Anaplasma marginale,* anaplasmosis affects cattle health, well-being, and production in many parts of the world and is characterized by severe anemia, fever, and weight loss. Despite this threat, there is no widely accepted vaccine for anaplasmosis.

Through their studies, Noh and her colleagues at Washington State University have identified important proteins to include in a potential vaccine, which is now being tested on animals. They found that small groups of the outer surface proteins of *A. marginale* induce an immune response that not only reduces symptoms, but can also prevent *A. marginale* infection in some animals. Some of the more promising vaccines being tested have protected 80 to 90 percent of the animals from clinical disease and have prevented infection in up to 40 percent of the animals.

"This is significant because infected animals may have no clinical evidence of infection, yet serve as sources of infection for others," says Noh. "No vaccine has ever prevented infection from *A. marginale* in cattle." Other countries have used an attenuated (weakened) strain (usually *A. centrale*) as a vaccine, and that vaccine protects against clinical disease, but not infection. Attenuated vaccines are prepared from live microorganisms or viruses that are cultured in the lab in such a way that they lose their virulence, but still confer disease immunity.

"To date we have only tested the vaccine against one strain of *Anaplasma*. In the field, many strains coexist. The next step is to determine whether this particular group of surface proteins will protect cattle from multiple strains of *Anaplasma,"* says Noh.—By **Sharon Durham,** ARS.

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